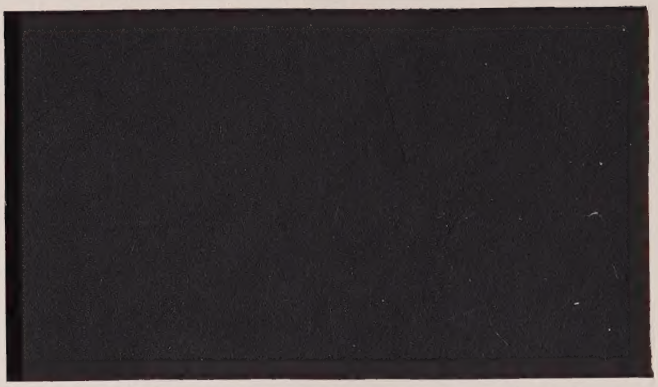
MODEL 121

PULSE GENERATOR

SERIAL NOS. A–

E-H RESEARCH LABORATORIES, INC.
163 ADELINE STREET · OAKLAND 20, CALIFORNIA



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PULSE GENERATOR

SERIAL NOS. A–

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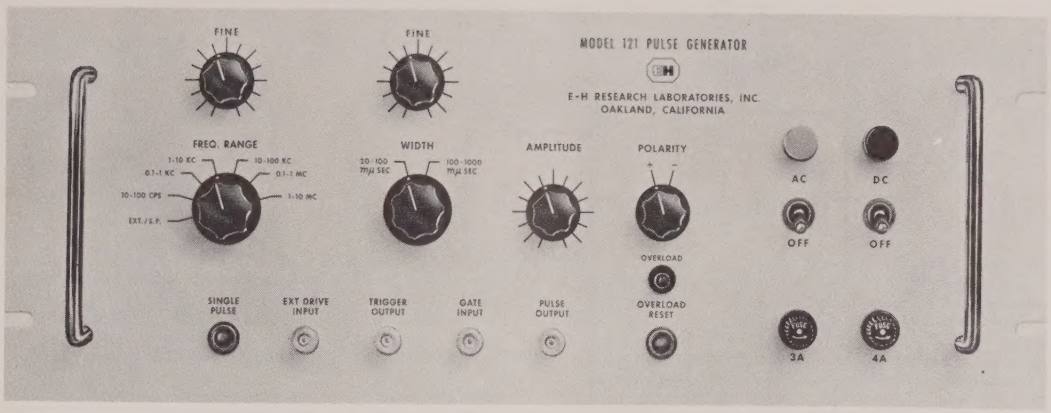


GENERAL INFORMATION

The E-H Model 121 Pulse Generator is designed to provide fast rise time, high current pulses over a broad range of pulse widths and repetition rates. Its unusual characteristics make it particularly useful in design problems involving magnetic materials, solid state research, high speed diode and transistor switching characteristics, and high current logic and memory circuits.

REPETITION RATE

An internal generator provides repetition rates continuously variable from 10 cps to 10 megacycles. A coarse selector switch and fine vernier are on the front panel for this purpose.

The instrument may be externally driven by placing the selector switch in the EXT/S.P. position. It may then be driven at any frequency from zero to 10 megacycles. The drive signal required is 5 volts rms or an equivalent positive pulse.

Single pulses may be obtained when the selector switch is in the EXT/S.P. position by depressing the SINGLE PULSE push button on the front panel.

RISE AND FALL TIME

Typically 4 to 5.5 nanoseconds rise time, 4.5 to 6 nanoseconds fall time, both positive and negative pulses, at maximum amplitude. Somewhat faster rise and fall times at reduced amplitudes.

OUTPUT

One amp peak pulse amplitude, delivering 50 volts into a 50 ohm load. The instrument MUST be terminated in the proper 50 ohm impedance. The output pulse amplitude may be varied from 5 to 50 volts by the front panel control.

POLARITY

Either positive or negative pulses may be obtained by means of a front panel polarity switch. The negative pulse is dc coupled directly from the output stage of the generator. The positive pulse is inverted by means of a transformer and so is ac coupled.

PULSE WIDTH

The output pulse width may be varied from typically 30 nanoseconds to 1.2 microseconds by a two position selector switch and fine vernier. The minimum obtainable width decreases at higher repetition rates to typically 10 nanoseconds above 5 megacycles.

DUTY FACTOR

The duty factor rating is 20 per cent. A protective relay will automatically disengage the output section if the pulse width exceeds 20 per cent of the period. The OVERLOAD light will then indicate that the pulse width must be decreased and the RESET button depressed to restore the output pulse.

TRIGGER

A positive 8 volt trigger pulse is provided which precedes the output pulse approximately 120 nanoseconds. For best results, when using the trigger to synchronize an oscilloscope or drive other equipment, it should be terminated in 91 ohms, preferably at the end of the cable.

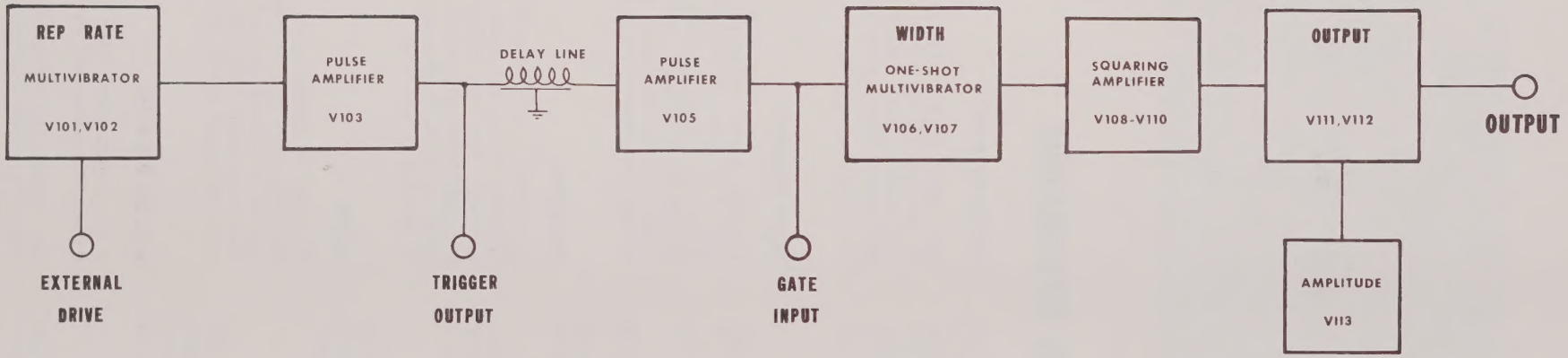
GATE

The gate is closed until a positive 20 volt signal is applied, which then interrupts the pulse train for as long as the gating signal remains. For step function input, the delay with which the gate acts, as referenced to output pulse, is typically 150 nanoseconds.

AC, DC POWER

For optimum tube life, the AC switch should be turned on at least 60 seconds before the DC switch.

The cooling fan will start with the AC switch. After unpacking a new instrument the dust filter should be checked to insure that it is not preventing the fan from rotating freely. The filter should be replaced or cleaned periodically.



MODEL 121 BLOCK DIAGRAM

CIRCUIT DESCRIPTION

Refer to the Block Diagram and the schematics at the rear of the book.

REP RATE MULTIVIBRATOR

The basic pulse is derived from a fast multivibrator consisting of V101, V102 and clamping diodes CR101 to CR104. On internal drive the multivibrator is in an astable configuration, generating square waves whose frequency is determined by the RC timing circuits and the potential of the network set by the FINE frequency control, R109.

The rise time of the multivibrator waveform is about 20 nanoseconds. C116 and R117 differentiate the leading edge of the waveform to produce an approximate 20 volt pulse, 25 nanoseconds wide, at the grid of V103. V103 is biased to cut-off, and so amplifies the positive pulse above the base line.

EXTERNAL DRIVE

When the FREQUENCY RANGE selector is in the EXT/S.P. position, the multivibrator is in a monostable configuration and may be driven either from the SINGLE PULSE pushbutton or an EXTERNAL drive signal. The external drive signal is amplified by V104A.

TRIGGER

The TRIGGER signal is taken from the secondary of T101 and applied to V104B thru C120. C120 and R182 divide the pulse applied to the grid of V104B such that its amplitude is proper to preclude the possibility of excessive dissipation in V104B. The final TRIGGER pulse is from the secondary of T103, which is damped to prevent reflections by R120.

Note: when using the TRIGGER to drive accessory equipment it is recommended that the cable (preferably RG-62) to the accessory equipment be terminated at its end in its characteristic impedance, to diminish reflections.

The delay thru the circuitry from V103 to the output pulse is approximately 45 nanoseconds. The purpose of the delay line between V103 and V105 is to provide additional delay such that the total trigger advance is 120 nanoseconds. This is the proper amount of trigger advance when using sampling type Oscilloscopes.

PULSE AMPLIFIERS

The pulse from V103 is applied to the grid of V105 thru the delay line, C123, and the peaking choke, L104. The delay line is terminated by R116, a 1.5k resistor. CR105 blocks the reflections coming back thru the delay line so the reflections see R170, also a 1.5k resistor. The delay line is then effectively back-matched, preventing recurring reflections.

Note: the circuitry throughout the entire instrument is such that the plates of the tubes are returned to ground and the cathodes to the -160 volt supply. The bias voltages discussed in the following text are in reference to the cathodes, for convenience, and are not the true potentials which can be measured.

Since the pulse is capacitively coupled to the grid of V105 thru C123, CR106 is utilized to clamp the grid at -7 volts. Thus base line shift with rep rate does not change the bias at the grid, and the tube is prevented from biasing itself off.

WIDTH ONE SHOT

V106 and V107, high Gm tubes, comprise a very fast one-shot multivibrator, which determines the WIDTH of the output pulse. The RC time constant is determined by C128 or C129 (depending upon the WIDTH selector switch position) and R130. R129, the FINE WIDTH control, sets the charging current to these capacitors. V106 is normally conducting and V107 is normally cut-off, the bias at the grid of V107 being determined by the division of R134 and R135 from the zener diode reference, CR111. When the negative pulse arrives at the grid of V106 it cuts off the tube, dropping the voltage across the cathode resistor, R125. The cathode of V107 is also returned thru R125, so it begins to conduct. The plate voltage of V107 then drops, and this signal is applied back to the grid of V106 to keep it cut off after the drive pulse dissapears. The time for the grid of V106 to return to the conducting region is determined by C128 or C129 and the charging current thru R128 and R129. The output pulse is taken from the plate of V106.

The purpose of CR110 is to clamp the grid of V106 and prevent it from going more positive than the 25 volts allowed by zener diode CR111. This sets the operating point of V106. CR109 passes only the negative pulse to the grid of V106, and prevents the drive signal from affecting the grid bias when the drive signal returns to its positive base level.

CR113 is a diode switch, necessitated by the practical problem of running leads to the front panel WIDTH selector switch. When the selector is in the 100-1000 mμsec position CR113 is biased so that it is conducting, and the path from the plate of V107 to the grid of V106 is thru the parallel combination of C128 and C129. With the selector switch in the 20-100 mμsec position CR113 is back biased, and the conducting path is thru only C128.

The width of the drive pulse to V106 is determined by the time constant of R122 in parallel with L105 or L106. With the WIDTH selector switch in the 100-1000 mμsec position the diode switch CR108 is back biased so that it is not conducting and the pulse is formed by R122 and L105. In the 20-100 mμsec position the diode is conducting and the pulse is formed by R122 and L106.

GATE

CR107 is for the purpose of the GATE. When a positive signal is applied to the GATE input CR107 is back biased, blocking the pulse train. Approximately 20 volts is required.

SQUARING AMPLIFIERS

The output of the one-shot multivibrator is applied to the grid of V108 thru the coupling capacitor, C133. The grid is clamped at -7 volts by CR112. It is also clamped to the cathode by CR116, preventing it from going positive with respect to the cathode. Therefore the grid swing of V108 is constrained to 7 volts, and it is driven from cut-off to saturation by the drive signal. since the drive pulse is much larger than 7 volts, V108 is a squaring amplifier.

T104 inverts the output from V108 so that it may be applied to the next stage. L109 is across the secondary of T104 to peak the rise time; R154 damps reflections.

V109 and V110 are similar squaring amplifiers, transformer coupled, and performing the function of steepening

the rise time. This steepening is accomplished because the amplitude of the pulse applied to each tube is much larger than its grid base swing.

OUTPUT SECTION

V111 and V112 are in parallel to form the output stage. The output pulse is taken directly from the plates. The sole purpose of the negative supply configuration used throughout the circuitry is so that the output pulse may be d-c coupled directly from the plates of the output tubes. This method yields maximum rise time. If the output pulse were a-c coupled, or if it were taken from the cathodes, such fast rise times could not be obtained.

Positive pulses are obtained by inverting thru the output transformer, T108. Negative pulses are also passed thru T108 so that the delay will be identical, but in this case there is no transformer action.

Note: the output transformer, T108, accounts for 1 to 2 nanoseconds of the output pulse rise time. If only negative pulses are required the rise time will be considerably improved by taking the output directly from the plates of the output stage, which is a minor modification.

The output amplitude is varied be means of the screen voltage to V111 and V112, which is supplied by the cathode follower, V113.

OVERLOAD PROTECTION

The OVERLOAD protection is accomplished by monitoring the screen and plate currents of V108, V109, and V110. These currents return to ground thru relay RL101, and the RESET pushbutton. If the duty factor exceeds 20 percent sufficient current flows to actuate RL101, which opens the ground return. RL101 has make-before-break contacts so that it holds open, preventing chatter at marginal levels. The RESET pushbutton must be depressed to break the hold circuit.

POWER SUPPLY

The -160 volt supply is derived from a conventional emitter follower circuit comprised of TR1 and TR2 in series. The bases of TR1 and TR2 are referenced to zener diodes CR10 and CR11.

A protective circuit comprised of CR3, CR4 and CR14 prevents damage to the transistors if the -160 volt bus is inadvertently short-circuited. If the -160 volt line drops below -120 volts CR3 and CR4 conduct, immediately dropping the base voltage of TR1 and TR2. This allows time for the fuse to blow before damage to the transistors occurs.

The -98 volt and -78 volt busses are divided from the -160 volt line thru zeners CR12 and CR13.

CR6 and CR7 comprise a voltage doubler whose voltage is added to the -160 volt bus thru zeners CR8 and CR9 to provide the -167 and -174 volt busses.

The +90 volt bus is derived from V1, an 0B2 gas tube regulator.

Note: TR1 and TR2 are mounted on heat sinks in the center section of the instrument. These heat sinks are insulated from ground. Use caution. Silicon grease should be applied when replacing zeners and transistors to insure proper heat conduction.

ADJUSTMENTS

REP RATE

The trimmer capacitors C107 and C113 for the 1-10 MC range of the rep rate multivibrator are adjusted at the factory and should require readjustment only if V101 or V102 is replaced. The procedure is to view the waveform at the cathode of V101 and adjust C107 and C113 until the waveform is a symmetric square wave, with the fine frequency control in the full counter-clockwise position. Then increase the fine frequency control and readjust the trimmers to maintain a roughly symmetric waveform. At 10 MC it will not appear symmetrical because of the loading of the following stage, but the period between the rising and falling edges should be roughly symmetrical.

DRIVE

The procedure for adjusting the drive, C116, is to observe the waveform at the plate of V105 with the WIDTH in the 100-1000 mμsec position. Increase C116 until the plate just reaches its maximum, that is, where it saturates. The drive should not be advanced beyond this point because it cause excessive plate dissipation in the tubes.

WIDTH

To adjust the fine width trimmer, C128, place the WIDTH selector in the 20-100 mμsec position and the FINE WIDTH control in the full clockwise position. Then increase C128 until the output pulse width is observed to be 100 mμsec.

MAINTENANCE

All tubes used in the instrument are rated 5000 hours or better. Occasional tube replacement or routine replacement of electrolytic condensers are the main maintenance requirements of this instrument.

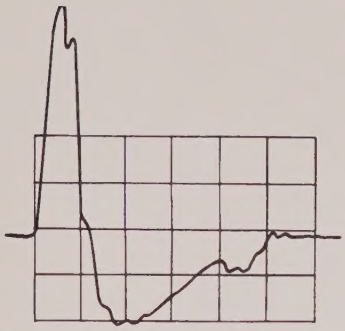
TROUBLE SHOOTING

First check all supply voltages. These are available on the power supply deck and are indicated. Most supply problems can be traced to transistor or zener diode failures.

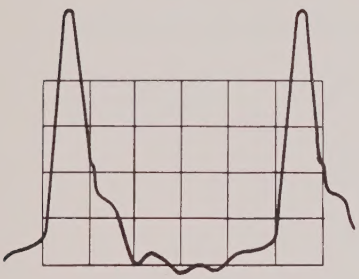
Trouble shooting is best accomplished by checking each stage in sequence, plugging in one tube at a time starting with the rep rate multivibrator and continuing thru to the output section.

Most of the tubes throughout the instrument have resistors in the plate, cathode and screen circuits, The drops across these resistors may be measured to determine if the currents are within the rating of the particular tube. These resistors also tend to act as fuses, since a failure causing excessive dissipation will usually burn up the resistor before the tube is damaged. A visual inspection may reveal this condition.

The following waveforms will help indicate if the particular stage is operating properly. They were taken on a Tektronix type 581 Oscilloscope with a type 80 Plug-in. Be sure the scope probe is properly grounded to eliminate ringing due to ground loops.



Secondary of T101
5 volts/cm
.05 μsec/cm
1 MC rep rate



Secondary of T101
5 volts/cm
.02 μsec/cm
10 MC rep rate

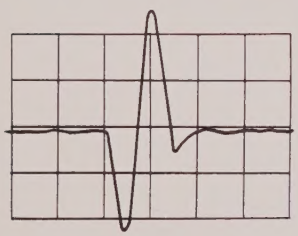


Plate of V105
10 volts/cm
.05 μsec/cm
100-1000 mμsec Width
1 MC rep rate

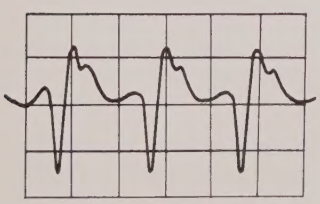
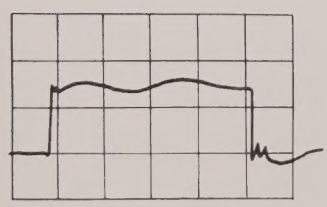
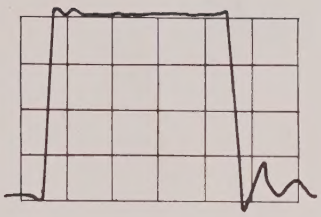


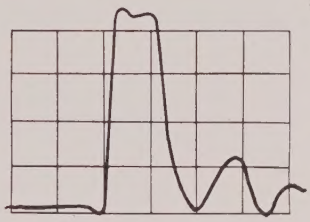
Plate of V105
5volts/cm
.05 μsec/cm
20-100 mμsec Width
10 MC rep rate



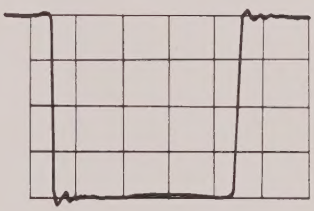
Grid of V108
5 volts/cm
.2 μsec/cm
1 μsec Width
100 KC rep rate



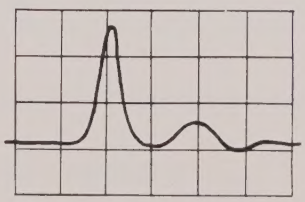
Secondary of T107
10 volts/cm
.02 μsec/cm
1 MC rep rate



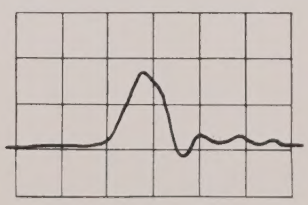
Secondary of T107
10 volts/cm
.01 μsec/cm
10 MC rep rate



Output Pulse
10 volts/cm
.05 μsec/cm
1 MC rep rate



Trigger Output
5 volts/cm
.02 μsec/cm
1 MC rep rate



Grid of V108
5 volts/cm
.02 μsec/cm
15 mμsec Width
1 MC rep rate

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PARTS LIST

ORDERING INFORMATION

To insure your receiving the proper replacement part, please include the following information with your order.

1. Model Number and Serial Number of the instrument for which the replacement part is intended.
2. Circuit Reference of the part.
3. E-H Part Number.

Replacement parts may be ordered through your E-H Representative or from the factory.

WARRANTY

This instrument is guaranteed to be free from defects in material and workmanship. Our obligation is limited to repairing the instrument should it prove to be defective, upon our examination, within one (1) year after the purchase date. Fuses and batteries are specifically excluded from warranty. Electron tubes, transistors, and diodes are warranted for six (6) months.

For In-Warranty repair of this instrument contact E-H Research Laboratories, Customer Service Department, and provide:

1. Instrument Model Number and Serial Number
2. Full details of the nature of the malfunction

Shipping instructions, or repair information and parts, will be given you promptly.

CUSTOMER SERVICE DEPARTMENT, E-H RESEARCH LABORATORIES, INC.

163 ADELINE STREET, OAKLAND, CALIFORNIA - Phone: TE 4-3030, Area Code 415

CIRCUIT REFERENCE	DESCRIPTION	E-H PART NO.
C1	capacitor, fixed, electrolytic, 100 uf, 450 wvdc	316-008
C2	capacitor, fixed, electrolytic, 200 uf, 350 wvdc	316-027
C3	capacitor, fixed, electrolytic, 250 uf, 50 wvdc	316-010
C4	Not used.	
C5	capacitor, fixed, electrolytic, 100 uf, 150 wvdc	316-023
C101	capacitor, fixed, metalized, mylar, .5 uf, ±5%, 200 v	320-009
C102	capacitor, fixed, metalized, mylar, .05 uf, ±5%, 200 v	320-005
C103	capacitor, fixed, polystyrene, .005 uf, ±5%, 500 v	326-004
C104	capacitor, fixed, polystyrene, 500 pf, ±5%, 500 v	326-003
C105	Not used.	
C106	capacitor, fixed, polystyrene 50 pf, ±5%, 500 v	326-001
C107	capacitor, variable, ceramic, 4-30 pf, 500 v	332-002
C108	capacitor, fixed, metalized, mylar, .5 uf, ±5%, 200 v	320-009
C109	capacitor, fixed, metalized, mylar, .05 uf, ±5%, 200 v	320-005
C110	capacitor, fixed, polystyrene, .005 uf, ±5%, 500 v	326-004
C111	capacitor, fixed, polystyrene, 500 pf, ±5%, 500 v	326-003
C112	capacitor, fixed, polystyrene, 50 pf, ±5%, 500 v	326-001
C113	capacitor, variable, ceramic, 4-30 pf, 500 v	332-002
C114	capacitor, fixed, metalized, mylar, .1 uf, ±20%, 200 v	320-006
C115	capacitor, fixed, ceramic .01 uf, 600 v	311-012
C116	capacitor, variable, ceramic, 7-45 pf, 500 v	332-001
C117	capacitor, fixed, ceramic, . .001 uf, ±10%, 1 KV	311-009
C118	capacitor, fixed, ceramic, .01 uf, 600 v	311-012
C119	capacitor, fixed, ceramic, .01 uf, 600 v	311-012
C120	capacitor, fixed, ceramic, 20 pf, ±10%, 1 KV	311-002
C121	capacitor, fixed, ceramic, .01 uf, 600 v	311-012
C122	capacitor, fixed, ceramic, .01 uf, 600 v	311-012
C123	capacitor, fixed, ceramic, 100 pf, ±10%, 1 KV	311-007
C124	capacitor, fixed, ceramic, .1 uf, +80-30%, 75 v	311-014
C125	capacitor, fixed, ceramic, .01 uf, 600 v	311-012
C126	capacitor, fixed, ceramic, .01 uf, 600 v	311-012
C127	capacitor, fixed, ceramic, 250 pf, ±20%, 1 KV	311-004
C128	capacitor, fixed, ceramic, .1 uf, +80-30%, 75 v	311-014
C129	capacitor, fixed, ceramic, 330 pf, ±10%, 1 KV	311-029
C130	capacitor, fixed, ceramic, 50 pf, ±10%, 1 KV	311-006
C131	capacitor, fixed, electrolytic, 20 uf, 250 wvdc	316-024
C132	capacitor, fixed, metalized, mylar, .1 uf, ±20%, 200 v	320-006
C133	capacitor, fixed, ceramic, .01 uf, 600 v	311-012
C134	capacitor, fixed, ceramic, 30 pf, ±20%, 500 v	311-005
C135	capacitor, fixed, ceramic, .01 uf, 600 v	311-012
C136	capacitor, fixed, ceramic, .01 uf, 600 v	311-012
C137	capacitor, fixed, ceramic, 10 pf, ±10%, 1 KV	311-001
C138	capacitor, fixed, metalized, mylar, .5 uf, ±20%, 200 v	320-008
C139	capacitor, fixed, ceramic, .001 uf, ±10%, 1 KV	311-010
C140	capacitor, fixed, ceramic, .001 uf, ±10%, 1 KV	311-010
C141	capacitor, fixed, metalized, mylar, 1 uf, ±20%, 200 v	320-010
C142	Not used.	
C143	capacitor, fixed, ceramic, .01 uf, 600 v	311-012
C144	Not used.	
C145	capacitor, fixed, ceramic, .01 uf, 600 v	311-012
C146	Not used.	
C147	capacitor, fixed, ceramic, 25 pf, ±10%, 1 KV	311-003

CIRCUIT REFERENCE	DESCRIPTION	E-H PART NO.
C148	capacitor, fixed, ceramic, .01 uf, 600 v	311-012
C149	Not used.	
C150	Not used.	
C151	capacitor, fixed, electrolytic, 250 uf, 50 wvdc	316-010
C152	capacitor, fixed, ceramic, .01 uf, 600 v	311-012
C153	capacitor, fixed, ceramic, .1 uf, +80-30%, 75 v	311-014
C154	capacitor, fixed, metalized, mylar, 1 uf, ±20%, 200 v	320-010
C155	capacitor, fixed, ceramic, .01 uf, 600 v	311-012
C156	capacitor, fixed, metalized, mylar, .1 uf, ±20%, 200 v	320-006
C157	capacitor, fixed, ceramic, .01 uf, 600 v	311-012
C158	capacitor, fixed, metalized, mylar, 1 uf, ±20%, 200 v	320-010
C159	capacitor, fixed, metalized, mylar, .1 uf, ±20%, 200 v	320-006
C160	capacitor, fixed, ceramic, .01 uf, 600 v	311-012
C161	capacitor, fixed, ceramic, .1 uf, +80-20%, 500 v	311-023
C162	capacitor, fixed, ceramic, .01 uf, 600 v	311-012
C163-64	capacitor, fixed, ceramic, .1 uf, +80-30%, 75 v	311-014
C165	capacitor, fixed, ceramic, .01 uf, 600 v	311-012
C166	capacitor, fixed, ceramic, 100 pf, ±10%, 1 KV	311-007
C167	capacitor, fixed, metalized, mylar, .1 uf, ±20%, 200 v	320-006
C168	capacitor, fixed, ceramic, .001 uf, ±10%, 1 KV	311-010
C169	capacitor, fixed, metalized, mylar, .5 uf, ±5%, 200 v	320-009
C170	capacitor, fixed, ceramic, .01 uf, 600 v	311-012
C171	capacitor, fixed, ceramic, .1 uf, +80-30%, 75 v	311-014
C172-74	capacitor, fixed, ceramic, .01 uf, 600 v	311-012
C175	capacitor, fixed, ceramic, 10 pf, ±10%, 1 KV	311-001
C176	capacitor, variable,ceramic, 7-100 pf, 250 v	332-003
C177-79	capacitor, fixed, ceramic, .1 uf, +80-20%, 500 v	311-023
C180	capacitor, fixed, ceramic, .001 uf, ±10%, 1 KV	311-010

CIRCUIT REFERENCE	DESCRIPTION	E-H PART NO.
CR1-6	diode, 1N2071	376-034
CR8-9	diode, zener, 1.5 w, 6.8 v, ±10%	374-028
CR10	diode, zener, 1.5 w, 30 v, ±10%	374-006
CR11	diode, zener, 1M3011A, 10 w, 150 v, ±10%	374-029
CR12	diode, zener, 1N3001A, 10 w, 68 v, +10%	374-018
CR13	diode, zener, 1N2985A, 10 w, 22 v, ±10%	374-013
CR14	diode, 1N2071	376-034
CR101-04	diode, 1N34A	376-023
CR105-09	diode, 1N914B	376-022
CR111	diode, ID6-050	376-039
CR112-13	diode, 1N914B	376-022
CR115	diode, 1N2071	376-034
CR116-17	diode, 1N914B	376-022
SW1-2	switch, toggle, DPST	630-006
SW101	Factory replacement only.	
SW102	switch, rotary, 2P2T	624-004
SW103	switch, rotary, 3P2T	624-023
SW104	switch, pushbutton, shorting	635-003
SW105	switch, pushbutton, shorting	635-002
T1	transformer, filament	650-001A
T2	transformer, power	653-006
T101	transformer, pulse	10204-01
T103	transformer, trigger	10239-01
T104	transformer, interstage output	10241-01
T106-07	transformer, interstage output	10241-01
T108	transformer, output	10240-01
V1	electron tube, OB2, voltage regulator	670-008
V101-02	electron tube, 6922, twin triode	670-006
V103	electron tube, 6688/E180F, pentode	670-004
V104	electron tube, 6922, twin triode	670-006
V105	electron tube, 6688/E180F, pentode	670-004
V106	electron tube, 7788/E810F, twin triode	670-023
V107	electron tube, 6688/E180F, pentode	670-004
V108	electron tube, 7788/E810F, twin triode	670-023
V109-12A	electron tube, 6939, twin tetrode	670-025
V113	electron tube, 7119, twin triode	670-021

CIRCUIT REFERENCE	DESCRIPTION	E-H PART NO.
L101-02	inductor, fixed, 2.4 uh, ±10%	335-009
L103	inductor, fixed, 1.5 uh, ±10%	335-001
L104	inductor, fixed, 8.2 uh, ±10%	335-007
L105	inductor, fixed, 3.9 uh, ±10%	335-003
L106	inductor, fixed, 1.5 uh, ±10%	335-001
L107	inductor, fixed, .33 uh, ±10%	335-005
L108	inductor, fixed, 1.5 uh, ±10%	335-001
L109	inductor, fixed, .68 uh, ±10%	335-013
R1-2	resistor, fixed, wirewound, 5 ohm, ±5%, 3 w	610-003
R3-4	resistor, fixed, composition, 120 ohm, ±5%, 2 w	598-121
R5	resistor, fixed, composition, 100 K, ±5%, 2 w	598-104
R6	resistor, fixed, wirewound, 30 ohm, ±3%, 25 w	610-025
R8	resistor, fixed, composition, 3.3 K, ±5%, 2 w	598-332
R10	resistor, fixed, wirewound, 10 K, ±5%, 10 w	610-022
R11	resistor, fixed, wirewound, 1.5 K, ±5%, 10 w	610-038
R12	Same as R1.	610-003
R13	resistor, fixed, wirewound, 6 K, ±5%, 10 w	610-043
R14	resistor, fixed, composition, 1 K, ±5%, 1 w	597-102
R16	Same as R1.	610-003
R17	resistor, fixed, composition, 300 ohm, ±5%, 2 w	598-301
R18	resistor, fixed, composition, 3.3 ohm, ±5%, 1 w	597-033
R102	resistor, fixed, composition, 680 ohm, ±5%, 2 w	598-681
R103	resistor, fixed, composition, 10 K, ±5%, 1 w	597-103
R105	resistor, fixed, composition, 91 K, ±5%, 1 w	597-913
R106	resistor, fixed, composition, 62 K, ±5%, 1 w	597-623
R107	Same as R105.	597-913
R108	Same as R106	597-623
R109	potentiometer, composition, linear taper, 100 K, ±10%, 2 w	550-006
R125	resistor, fixed, composition, 750 ohm, ±5%, 2 w	598-751
R127	Same as R125.	598-751
R129	Same as R109.	550-006
R130	resistor, fixed, composition, 10 K, ±5%, 2 w	598-103
R133	resistor, fixed, composition, 30 K, ±5%, 2 w	598-303
R141	Same as R17.	598-301
R144	Same as R14.	597-102
R149	resistor, fixed, composition, 100 ohm, ±5%, 1 w	597-101
R157	resistor, fixed, composition, 360 ohm, ±5%, 2 w	598-361
R159	resistor, fixed, composition, 270 ohm, ±5%, 2 w	598-271
R161	potentiometer, comp, linear taper, 50 K, ±10%, 2 w	550-005
R164	resistor, fixed, composition, 16 ohm, ±5%, 1 w	597-160
R165	resistor, fixed, composition, 62 ohm, ±5%, 2 w	598-620
R166	resistor, fixed, composition, 4.7 ohm, ±5%, 1 w	597-047
R167	Same as R157.	598-361
R173	Same as R14.	597-102
R175	resistor, fixed, composition, 510 ohm, ±5%, 1 w	597-511
NOTE:	All resistors on the schematic, which are not shown on this list, are 1/2 watt, ±5%, fixed, carbon composition.	
	Connector, power, 3-prong, chassis receptacle	700-018
	Fan blade, 4", counterclockwise	493-002
	Fan motor (without blade)	570-001
	Fuse extractor post	396-001
F1	Fuse, 3 amp, slo-blo	398-003
F2	Fuse, 1 amp, instantaneous	398-008
LT1-2	Pilot light assembly, neon, red	510-008
LT3	Pilot light assembly, neon, red, with 100 K resistor	510-003
	Power cable, 3-prong	786-001
RL101	Relay, 2-position, 150 ohm	584-002
TR1-2	Transistor, 2N1363	663-008

REVISIONS						
ISSUE	REVISION	DATE	DRAWN	CHK'D	APP'D	E.O.
D	REVISED	4/18/62	XD			

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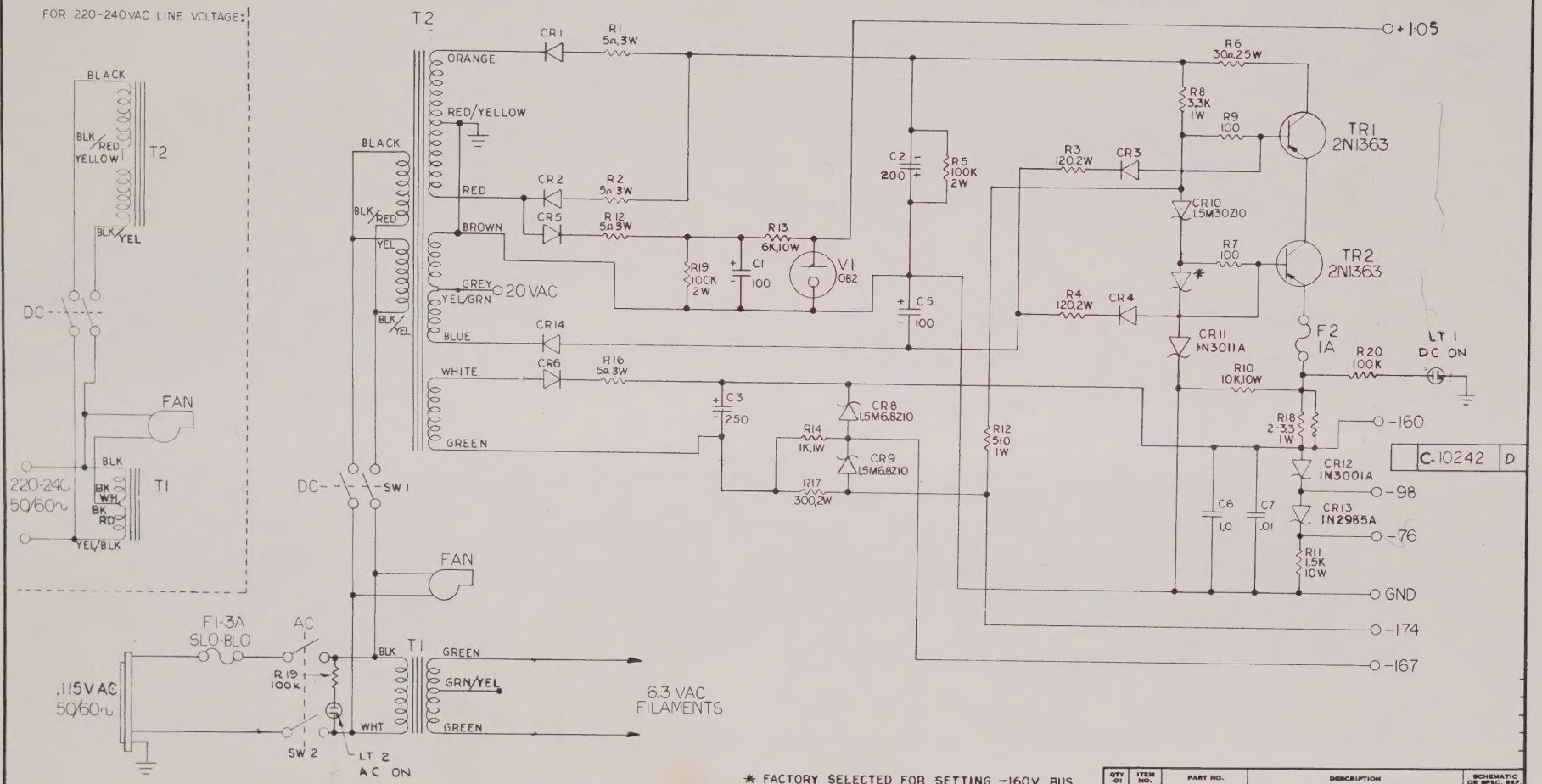


* FACTORY SELECTED FOR SETTING -160V BUS.

QTY -01	ITEM NO.	PART NO.	DESCRIPTION	SCHEMATIC OR SPEC. REF.

MATERIAL LIST

REQ'D | USED ON | NEXT ASS'Y | VAR.

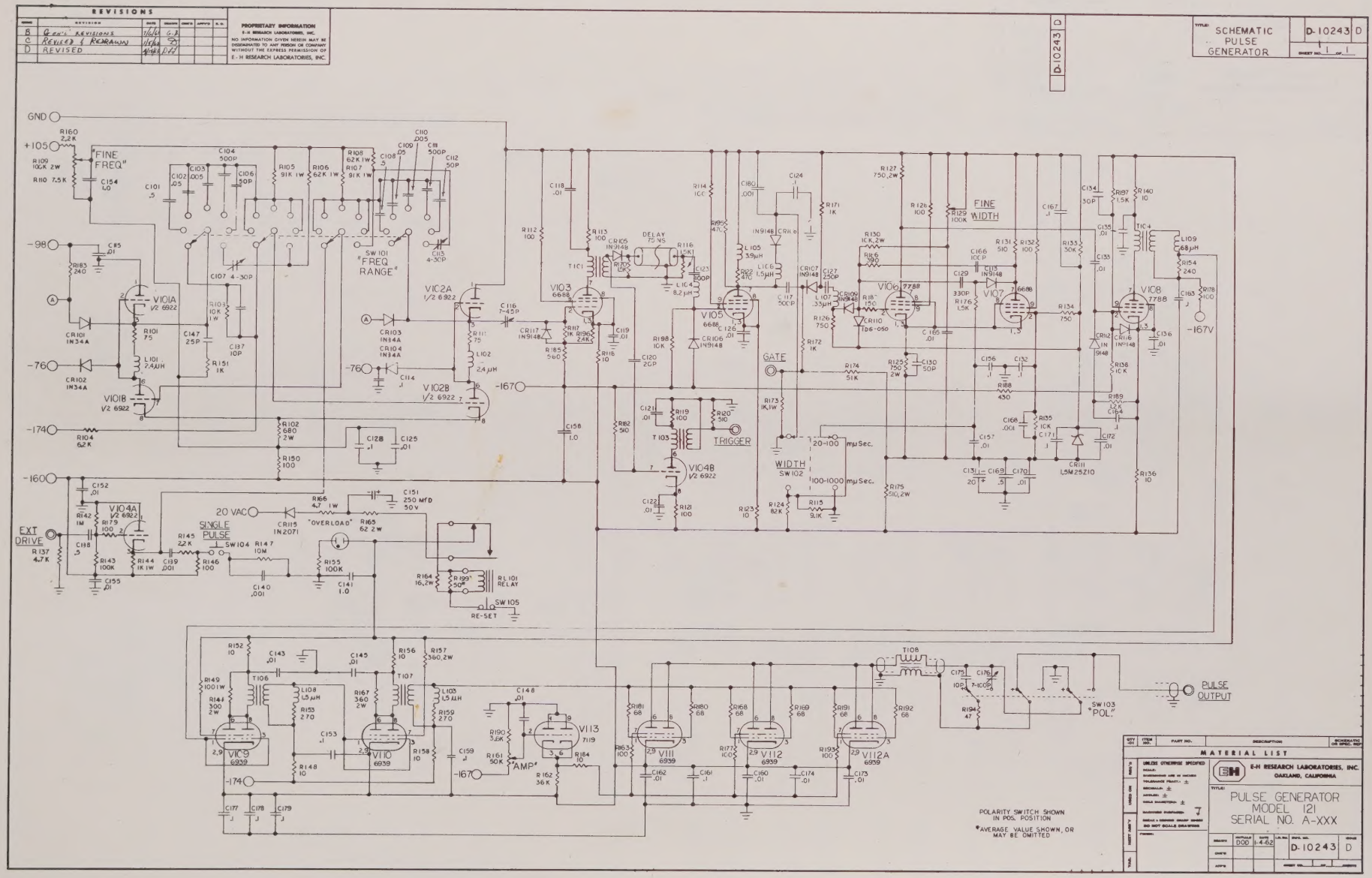
URLESS OTHERWISE SPECIFIED
SCALE:
DIMENTIONS ARE IN INCHES
TOLERANCE FRACT.: ±
DECIMALS: ±
ANGLES: ±
HOLE DIAMETERS: ±
MACHINED SURFACES: √
BREAK & DEBURR SHARP EDGES
DO NOT SCALE DRAWING
FINISH:

RESEARCH LABORATORIES, INC.
OAKLAND, CALIFORNIA

TITLE:
PULSE GENERATOR
POWER SUPPLY
SERIAL NOS. A-XXX

	INITIALS	DATE	I.D. No.	DWG. NO.	ISSUE
DRAWN	DOD	1-5-62		C-10242	D
CHK'D					
APP'D					

SHEET NO. ____ OF ____ SHEETS


REVISIONS
PROPRIETARY INFORMATION
E-H RESEARCH LABORATORIES, INC.
D-10243 D
SCHEMATIC PULSE GENERATOR
GND
+105
-98
-76
-174
-160
-167
+167
-167V
FINE FREQ"
"FREQ RANGE"
FINE WIDTH
GATE
TRIGGER
WIDTH SW102
20-100 mμ Sec.
100-1000 mμ Sec.
EXT DRIVE
SINGLE PULSE
SW104
20 VAC
"OVERLOAD"
RL 101 RELAY
RE-SET
SW105
AMP
SW103 "POL"
PULSE OUTPUT
POLARITY SWITCH SHOWN IN POS. POSITION
*AVERAGE VALUE SHOWN, OR MAY BE OMITTED
MATERIAL LIST
E-H RESEARCH LABORATORIES, INC.
OAKLAND, CALIFORNIA
PULSE GENERATOR
MODEL 121
SERIAL NO. A-XXX
D-10243 D

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